MECHANICAL & INDUSTRIAL ENGINEERING COLLOQUIUM: ME 794 002 SP'2017

3D Printed Neuro-bionic Brain Organoids & Neural Prosthetics for Fundamental Studies and Applications in Neurological Disorders

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Abstract

This talk presents our research in the various areas of **Neuro-bionics** and **Translational Neural Engineering**. Specifically, three major thrust areas of our current research are: 1. Creation of **Neurobionic Brain Organoids** using patient derived induced pluripotent stem cells (iPSCs) for fundamental studies of human brain development and more importantly, studies on developmental etiology of various neurological disorders (NDs) 2. **Neuro-modulation** and **Neural control** therapies for disorders such as intractable epilepsies, Parkinson's etc. and 3. Design and engineering of **Cognitive- Sensory- and Motor- Neuro-prosthetics** and **Soft Neuro-robotics** via neuro-bionic hybrids and interfaces that link the human nervous system with electronic or robotic prostheses for neuro-rehabilitation applications in disabled patients. The first part presents our lab's focus in 3D printing of multiple iPSC based neuronal cells, derived from select cohort of patients for creating 3D neuro-bionic organoids as a strategy to model various neurological disorders. An immediate therapeutic role for our iPSC based Neuro-Bionic Organoids is as platforms for the discovery of new therapeutic strategies. Therefore another major focus in our lab is in using the disease specific neurobionic brain organoids in developing and studying the efficacy of electro-neuromodulation techniques. Another major thrust area where we have devoted considerable scientific and technological efforts have been in the development of neuroprostheses and hybrid bionic systems that link the human nervous system with electronic or robotic prostheses, with the main aim of restoring cognitive, motor and sensory functions in disabled patients.

Biography:

Manu Sebastian Mannoor's research interests focuses on the integration of molecular, cellular and cognitive neurosciences and neurobiology with electrical, mechanical, biomedical and material sciences and engineering. This multidisciplinary research program is shaped by Manu's highly interdisciplinary academic training with M.A. and Ph.D. from Princeton University in Mechanical and Materials Sciences & Engineering (2012 and 2014 respectively), M.S from NJIT in Biomedical Engineering (2008) and undergraduate education in Electronics Engineering from the University of Calicut, India (2006) and his research training in developmental neurobiology, bionic organs and bio-integrated electronics. Manu's research in this direction has led to publications in major journals, significant patent applications and numerous presentations and invited talks. His work has been highlighted by major scientific journals such as Science, Nature and Nature Nanotechnology and popular media outlets, including being featured as "*an innovation that will change your tomorrow*" by New York Times Magazine and one of the inventions in The CNN 10: Inventions. While at Princeton, Manu has also received a number of awards, most prominently, the Material Research Society Gold Award (2012) for outstanding graduate research and the Princeton University Emerging Alumni Scholars Award (2013) "*for the excellence of his dissertation work and the merits of his distinguished career at Princeton*". Manu's teaching efforts has also been recognized by the Luigi Crocco Award for Teaching Excellence for the undergraduate instruction at Princeton. For More Information Contact: Prof. Lu Lu, lulu@njit.edu ext. 3349